European Scientific Journal November 2015 edition vol.11, No.33 ISSN: 1857 – 7881 (Print) e - ISSN 1857- 7431

IMPROVING QUALITY OF LIFE AFTER HIP REVISION ARTHROPLASTY

Tudor Sorin Pop*, *Associate Professor, MD, PhD
Sandor-Gyorgy Zuh*, *Assistant Professor, MD, PhD
Department of Orthopedics and Traumatology
University of Medicine, UMF Tîrgu-Mureş, Romania
Margit Hidi, MD
Attila Vass, MD
Clinics of Orthopedics and Traumatology
Mureş County Clinical Hospital, Tîrgu-Mureş, Romania
Istvan Gergely*, *Lecturer, MD, PhD
Department of Orthopedics and Traumatology
University of Medicine, UMF Tîrgu-Mureş, Romania

Abstract

Nowadays the number of primary arthroplasties is growing and revision arthroplasty is becoming increasingly necessary. In this study we intend to examine the effectiveness of arthroplasties and assess the quality of life. We included 35 patients with revision arthroplasty and 35 primary hip arthroplasty patients who had surgery between 2011 and 2012 in the study. To examine the results we used the modified Harris hip score and the Rosser matrix, which was completed before surgery and 2-3 years after the procedure. We observed a statistically significant improvement: from 34 preoperative Harris hip score 75 at the 2 years postsurgery assessment and 72 at the 3 years postoperative assessment ($p < 0.0001$). Significant improvements were also registered when assessing the health state with the Rosser matrix. The effect for the Harris score had a value of 2.06 which testifies the revision surgery has a high effectiveness. This means that with this kind of procedures dramatic improvement in quality of life can be achieved.

Keywords: Quality of life, hip revision arthroplasty.

Introduction

Millions have the chance to live a full and active life due to total hip arthroplasty. In the last 50 years we have seen a considerable improvement in

the design and structure of prostheses and surgical techniques which yielded very good results in the long term. It remains the problem of aseptic loosening of the prosthesis, which requires additional surgery to change the prosthesis. A primary implant has 80% chance to survive 20 years, although in male or obese patients this is considerably reduced. The most common indications for revision arthroplasty of the hip prosthesis is pain due to losing the prosthesis, fractures of the femur and septic complications of primary arthroplasty.

Revision hip arthroplasty is considered a difficult and lengthy intervention. Any patient can experience a lot of problems and complications such as osteolysis, osteoporosis, joint instability, fractures and difficulty of removing the implant or cement. Surgically solving the mobility of a prosthesis by bone destruction and protrusion cup is a great challenge to orthopedic surgeons. Lately excision arthroplasty of the hip with leaving behind the secondary Girdlestone hip is very rare, although the number secondary interventions show an upward trend. The most accepted solution for such hip surgeries was developed by (Gie et al., 1993) using impaction bone grafting with cemented prosthesis. Homologous spongy bone tissue has a - histologically confirmed - slow reorganization process, thereby, together with the bone cement, helping to stabilize the new endoprosthesis. The encouraging results registered until the present days confirm the broad application of the technique, but it can be used only if the medical staff has the necessary training and master the necessary techniques in the appropriate conditions. The aim of revision surgery is to relieve pain and restore proper hip function.

Although the number of revision hip arthroplasty is growing, there are relatively few studies on the effectiveness of this intervention shown in (approved) quality of life scores. Using questionnaires developed by (Zmistowski, Hozack, & Parvizi, 2011), (Kanis et al., 2001), (Atroshi et al., 2004) and (Shi, Mau, Chang, Wang, & Chiu, 2009), reporting medium and long term outcomes post revision arthroplasty became possible.

Recently (Britton, Murray, Bulstrode, McPherson, & Denham, 1996) have questioned tracking the endoprosthetic components as the sole method to measure the efficacy of revision arthroplasty, demonstrating that other variables, such as pain, may also be useful in determining effectiveness.

The main purpose of this study is to compare the quality of life after primary arthroplasty and hip revision. The secondary purpose was to assess the medium-term improvement in quality of life in patients after revision arthroplasty.

Materials and methods

There were two groups of patients included in this study with simple

random sampling. In the first group of 35 patients, who underwent revision hip arthroplasty for aseptic loosening at the Mureș County Orthopaedics and Traumatology Clinic between 2011-2012. In most cases both components of the endoprosthesis were changed. Surgeons performed acetabular reconstruction with Protetim acetabular reinforcement device and homologous bone-graft. Other 35 patients undergoing primary hip arthroplasty were included in the second group, where in most cases a cemented prosthesis was implanted.

Data were collected using a Harris Hip Score (HHS) questionnaire (Harris, 1969). The quality of life was measured on a measuring scale of health status called Rosser matrix (Rosser & Kind, 1978) comparing preoperative results with the 2-3 years postoperative results. The patient's subjective view/opinion about the results of the intervention was also reviewed. Satisfaction was measured on a scale from 1 to 10, where 1 means not satisfied at all and 10 very satisfied.

The response rate to the questionnaire 2 years after the intervention of the group undergoing revision surgery was 77% (27 completed questionaries out of 35 sent out) and 3 years postoperative was 71.4% (25 patients answered the questions out of 35). The rate in the group undergoing primary arthroplasty was 66% 2 and 3 years postoperative (23 patinets anwered out of 35). So the answers of 23 patients undergoing primary arthoplasty were compared to the 25 and 27 answers of revision arthroplasty patients. Although the number of patients was small evaluation and comparison was statistically possible. The average age of patients with revision arthroplasty was 61.1 years (± 10 standard deviation; Range 45-79), out of which 13 men and 12 women. In the group with primary arthroplasty the average age was 64.1 years (± 5 standard deviation; Range 57-73), out of which 14 men and 9 women.

Clinical assessment

Harris Hip Score

The Harris Score was introduced in 1969 (Harris, 1969), initially to follow up with patients undergoing hip arthroplasty after cervical fracture. Today Harris score is a method widely used in hip pathology for pre- and postoperative evaluation of patients. It is a multidimensional evaluation system consisting of 8 parameters. The final score varies within a range of from 100 (no disability) to 0 (maximum invalidity).

The patients' symptoms were assessed using the HHS. The score was recalculated before the intervention and 2 to 3 years after surgery. Before the surgery the HHS was recorded by the doctor treating the patient. After surgery modified HHS based questionnaires were sent out to the patients via mail, then filled out and sent back. By modified we understand that in order

to formulate the preoperative and postoperative questionnaires, we have taken from the original version only subjective parameters (pain, function). Thus the maximum possible score was 91 (44 pain and function 47).

Rosser Matrix (Table no. 1., Table no.2.) classification of illnes states

Assessment of "illness state" represents a great advantage, as it can be expressed through the medical benefit, being independent of technical details, survival rate or diagnosis. Such a measuring system is the Rosser Matrix. It is based on two parameters: pain and disability. It includes 29 variants of illness states and each corresponds to a value indicating the quality of life. Information can be collected in three ways:

- through questionnaires filled out by the patient;
- through clinical evaluation;
- processing of data already collected from the patient.

In our case the latter method was considered the most useful because it ensures that the obtained values reflect the results of intervention trials, assuming that the data are suitable to be processed multiple times.

Symptoms of patients preoperative and 2 or 3 years postoperative were recorded using the modified Harris hip score. The matrix based on pain and function turns information from a patient to a numeric value. Because of this quantitative character, the value can be inserted easily into the Rosser categories of pain and disability, which will then compose the Rosser matrix. Rosser values range between -1.486 and 1.000. 1.000 represents the absolute health state, whereas 0.000 corresponds to a deathlike state. -1.486 is the numeric representation of a "worse off than dead" state.

The integration of different score systems in the Rosser health categories is a method questioned by many authors. Nevertheless Harris Hip score is very similar to the Rosser Matrix because patients respond to questions about their symptoms based on the same parameters (pain and disability).

Table no.1. Rosser matrix parameters

Disability Description	**Rating**
no disability	I
slight social disability	II
severe social disability and/or slight impairment of performance at work; able to do all housework except very heavy tasks	III
choice of work or performance at work severely limited; housewives and old people able to do light housework only but able to go out shopping	IV
unable to undertake any paid employment; unable to continue any education; old people confined to home except for escorted outings and short walks and unable to do any shopping; housewives able only to perform a few simple tasks	V
confined to chair or wheelchair; or only able to move around in house with support from an assistant	VI
confined to bed	VII
unconscious	VIII

Distress	**Rating**
no distress	A
mild	B
moderate	C
severe	D

Table no.2. The Valuation Matrix

Disability	**Distress A**	**Distress B**	**Distress C**	**Distress D**
I	1.00	0.995	0.99	0.97
II	0.99	0.986	0.97	0.93
III	0.98	0.97	0.96	0.91
IV	0.96	0.96	0.94	0.87
V	0.95	0.94	0.90	0.70
VI	0.88	0.85	0.68	0.00
VII	0.68	0.56	0.00	-1.49
VIII	-1.03	NA	NA	NA

Statistics

For statistical analysis we used SPSS program, version 13.0. Due to the asymmetric distribution of the data, we used non-parametric tests; in most cases we calculate the median instead of the average score.

Primary and revision groups were compared using Khi-square test on gender, and the Mann-Whitney-U test on age. The pre- and post-operative

Harris scores were also compared by Mann-Whitney-U test.

We calculated the "effect size" for 3 years after intervention revision arthroplasty (using the means and standard deviations in the two groups). Effect size measures the proportion of change in the patient's health state, on the scale it is measured with; so a value of 0.2 means a small improvement, 0.5 and 0.8 mean improvement or great improvement in health.

Radiological Assessment

The radiological evaluation was based on the postoperative and periodic (3, 12, 24 and 36 months postoperative) anteroposterior radiographs (AP). The aim of the radiological assessment was determning, by comparison, the center of rotation of the hip on an standard AP radiograph, determining the bone deficiency of the acetabulum, and the integration of a bone graft. This latter has been accepted as complete, as soon as it had the same density as the surrounding bone. For the components of the acetabulum, in order to describe the radiolucent areas, we used the areas proposed by DeLee and Charnley (DeLee & Charnley, 1976). We have considered the horizontal and the vertical migration of the implant.

In case of the femoral component, the radiolucent areas on the bone-cement interface were assessed according to the seven areas proposed by (Gruen, McNeice, & Amstutz, 1979). At the same time, any apparently cystic bone deficiency in the pre-acetabular and endosteal cortical femoral region were recorded. We also followed the alignment (varus, valgus or neutral) on the radiography. In case it had heterotopic ossification (HO), this was evaluated based on the Brooker classification (Brooker, Bowerman, Robinson, & Riley, 1973).

Results

The response rate to the questionnaire 2 years after the intervention of the group undergoing revision surgery was 77% (27 completed questionnaires out of 35 sent out) and 3 years postoperative was 71.4% (25 patients answered the questions out of 35). The rate in the group undergoing primary arthoplasty was 66% 2 and 3 years postoperative (23 patients answered out of 35).

In the group undergoing primary arthoplasty the registered Harris Hip Score was 34 points preoperative, 72 points 2 years after the intervention and 81 points 3 years postoperative. This represents a statistically significant improvement ($p<0.001$). The greatest improvement was registered with pain, its median increasing by 30 points ($p<0.001$). There has been a statistically significant increase of every constituent of the Harris Hips score median.

The registered Harris hip score of the patients who had revision arthoplasty was the following: 34 points before surgery, 75 points 2 years

after the intervention, dropping to 72 points 3 years postoperative (Fig. 1). Althouth this score is lower than the 81 points registered 3 years after primary arthroplasty, this difference is not significant statistically ($p>0.1$).

The two parameters of the Rosser matrix are pain and disability, the matrix includes 29 health states, each corresponding to a value which indicates the quality of life.

After surgery an increase of quality of life was recorded by every patient. The classification of patients according to the recorded value is illustrated in Table 3 and 4.

In the group who had primary arthoplasty the recorded preoperative median score was 0.891 (range from 0.700 to 0.990, average = 0.821). 3 years after the surgery the recorded median score was 0.984 (range from 0.942 to 1.000, average = 0.968). An increase of 0.093 of the Rosser median score is a statistically very significant increase ($p<0.0001$), which suggested a much better quality of life.

Preoperative Rosser score median of the group undergoing revision arthoplasty was 0.855 (range from 0.500 to 0.964, average = 0.995). 3 years after the surgery the recorded median score was 0.117 (95% confidence interval), which represents a statistically very significant increase ($p<0.0001$), which suggests a dramatic improvement in quality of life.

Table no. 3. Distribution of the 27 patients with revision arthroplasty in the Rosser matrix: (a) before surgery, (b) 3 years postoperative

a)	PAIN			
Disability	A	B	C	D
I	-	-	-	-
II	-	-	-	1
III	-	-	-	2
IV	-	-	4	5
V	1	3	4	4
VI	-	-	-	3
VII	-	-	-	-
VIII	-	-	-	-

b)	PAIN			
Disability	A	B	C	D
I	1	-	-	-
II	7	4	-	-
III	2	5	-	-
IV	-	2	2	-
V	-	-	-	-
VI	-	-	-	-
VII	-	-	-	-
VIII	-	-	-	-

Table no. 4. Distribution of the 23 patients with revision arthroplasty in the Rosser matrix: (a) before surgery, (b) 3 years postoperative

	PAIN			
Disability	A	B	C	D
I	-	-	1	-
II	-	-	2	2
III	-	1	2	1
IV	-	2	1	3
V	-	2	3	3
VI	-	-	-	-
VII	-	-	-	-
VIII	-	-	-	-

	PAIN			
Disability	A	B	C	D
I	5	-	-	-
II	6	-	-	-
III	3	1	-	-
IV	4	3	1	-
V	-	-	-	-
VI	-	-	-	-
VII	-	-	-	-
VIII	-	-	-	-

Comparing the results at 2 and 3 years after revision arthroplasty we found no statistically significant difference ($p = 0.6$ for Rosser matrix) so health (state) remained as good as 2 years after surgery.

We calculated the effect size for revision arthroplasty 3 years postoperative. We obtained values greater than 0.8 in each of the modified constituent of Harris hip score and a 2.06 overall score, attesting that revision arthroplasty effectiveness is very high and by undergoing this kind of surgery dramatic improvement in quality of life can be achieved.

The statistical comparison of the pre-surgery and 2 to 3 years post-surgery scores are presented in Table no. 5. Except limping there was no statistically significant difference between the other parameters registered when evaluating the 2 groups. Limping was slightly more severe in patients undergoing revision arthroplasty:

- In the first group (primary arthoplasty) 60% of patients did not limp, 25% of patients accused light limping, while 15% complained aboute niderate limbing;
- In the secong group (revision arthroplasty) 24 % of patients did not limp and 33% reporting a slight limping, whereas 33% complained about moderate limp.

Adding the points obtained for limping with other parameters like walking and physical activity, we observed that from a functional point of view there was no statistically significant difference between the two groups.

Comparing the Rosser matrix, we found no statistically significant difference ($p = 0.152$) so we can conclude that we have achieved with revision arthroplasty a higher quality of life, similar to that obtained after primary arthroplasty (which has been demonstrated many times to be the most cost-effective method for a dramatic improvement in quality of life).

Table no. 5. Statistical comparison of the results of preoperative, 2 postoperative and 3 years after surgery

Monitored parameters	Preoperative & 2 years postoperative (value of p)	2 & 3 years postoperative (value of p)
Pain intensity	0.0001	0.250
Use of drugs	0.024	0.637
Limp	0.005	0.499
Traveled distance	0.045	0.545
Auxiliary support	0.035	0.568
Climbing stairs	0.001	0.624
Dressing	0.000	0.785
Sitting	0.041	0.459
Access to means of transport	**0.115**	0.843
Walking	0.010	0.428
Physical activity	0.0001	0.524
Physical Function	0.003	0.464
Modified Harris hip score	0.0001	0.988
Rosser index value	0.0001	0.606

In the questionnaires patients' subjective view about the felt results of the surgery was also registered. This satisfaction was measured on a scale from 1 to 10, where 1 means not (at all) satisfied and 10 very satisfied.

The patients' response confirms previous statistical calculations. More than 85% of patients in both groups have chosen 10 or 9, suggesting that the majority of patients was very pleased with the results of the surgery. Between the two groups of patients, no statistically significant differences registered regarding satisfaction with the results of the surgery ($p = 0.2$).

Discussion

With hip replacement surgery decreased symptoms and substantial improvement of function can be obtained. However, like other operational techniques, the potential benefits of these methods should be evaluated in light of possible complications. Although revisions due to infections, fractures and dislocation have become relatively rare, secondary failure of aseptic mobilizations is more important, as its incidence is growing. It is currently estimated that over 25% of all implants will undergo mobilisation, leading to the need for maintenance intervention.

Aseptic loosening is an inevitable moment in the evolution of any prosthesis, in case the patient lives long enough post-surgery, so it does not necessarily has to be considered a final complication, but a moment of final evolution. By definition we can understand loosening as a deterioration of

biomechanical connection between the adequate prosthetic components and bone, along with the patients' alterations of clinical results.

There are several mechanisms that explain these observed facts and theories, yet none could explain the phenomenon entirely. Most likely these complex mechanisms overlap and complement each other.

The main purpose of this study was to determine the efficacy of revision arthroplasty on improving the quality of life of patients prosthesis.

Primary arthroplasty, which is very well researched and documented, is proven to be an effective intervention, was used as a reference (means of comparison) in this study. We decided to compare the revision arthroplasty with primary arthroplasty in this research.

After complex comparisons, we concluded that the improvements on quality of life of patients undergoing revision arthroplasty was similar to those who had primary arthroplasty. Even though the number of patients who participated in this study was small, the evaluation and comparison was statistically possible.

We observed that several aspects in the quality of life have improved. The biggest improvement was regarding pain (30 points in the modified Harris hip score). Yet another significant improvement was registered regarding walking and moderate physical activity. The only parameter on which there was no improvement was accessing public transportation, but here we believe that the advanced age of the patients (an average 64 years at the time of surgery, so, in present days aprox. 68 years old) is a more important factor than lower limb functionality.

A possible limitation of this study is the lack of data on the condition of patients before primary hip arthroplasty. In light of those figures we have obtained a deeper comparison with revision arthroplasty by evaluating and comparing individual health improvement after each intervention.

Quality adjusted life year (QALY)

Quality Adjusted Life Years have an important theoretical cost allocation because it takes into account both the quantity and quality of life, meaning that life expectancy is adjusted to quality of life. The duration and the amount of benefit obtained life that the patient is willing to sacrifice quality should also be estimated (Coast, 1992).

All the cost-effectiveness health evaluations should also express the benefits. It is used to calculate the benefits of different interventions which is then expressed in gained QALY. If with an intervention a person earns a year of life in perfect health, equal to 1 benefit gained. This benefit is called quality-adjusted life year. For example, a person who acquires a benefit of 0.6 to 0.9 for two years then 0.6-0.7 for the next three years has a health benefit of 2 x 3 x 0.3 + 0.1 = 0.9 QALY. Similarly, if based on the same

calculations, person B and C acquires a health benefit of 2.6 and 0.6, then the total benefit for A, B and C is 4 QUALY.

The aim of this study was to quantitatively determine and compare the effect of early primary and revision arthroplasty on quality of life without doing the above estimates on life expectancy and duration of the benefit. Therefore we decided not to calculate QALY sites even though it was claimed in this case.

Conclusion

Nowadays the number of primary arthroplasties is growing so, revision arthroplasty will be required more often. Revision arthroplasty often - because of bone destruction - is considered a difficult and long intervention that requires acetabular reconstruction and/or femoral bone graft substitution of the bone deficit. However it is proven taht it is a very effective method, the effectiveness of this method being 2.06.

The revision arthroplasty can get a subjective and objective improvement in quality of life ($p<0.0001$) similat to primary hip arthroplasty ($p=0.1$).

Patients who underwent revision arthroplasty were equally satisfied with their results as those with primary arthroplasty ($p = 0.2$).

By using new techniques of cementing in primary arthroplasty revision arthroplasty is decreasing. Furthermore, the advanced surgical technology/technique makes possible even the reconstruction of mobilized prosthetic hip or significant bone destruction.

The result of the revision intervention depends on the choice of implant and proper technique. In recent years, implants have developed enormously, demonstrating the unquestionable superiority of "new age" implants. All this has led to a significant improvement of technical revision. Do not forget, however, that revision arthroplasty surgery is a delicate intervention and its success depends on the experience of the surgical team and on the technical conditions such as the existence/presence of different types and sizes of implants and bone grafts.

References:

Atroshi, I., Ornstein, E., Franzen, H., Johnsson, R., Stefansdottir, A., & Sundberg, M. (2004). Quality of life after hip revision with impaction bone grafting on a par with that 4 years after primary cemented arthroplasty. Acta Orthop Scand, 75(6), 677-683.

Britton, A. R., Murray, D. W., Bulstrode, C. J., McPherson, K., & Denham, R. A. (1996). Long-term comparison of Charnley and Stanmore design total hip replacements. J Bone Joint Surg Br, 78(5), 802-808.

Brooker, A. F., Bowerman, J. W., Robinson, R. A., & Riley, L. H., Jr. (1973).

Ectopic ossification following total hip replacement. Incidence and a method of classification. J Bone Joint Surg Am, 55(8), 1629-1632.
Coast, J. (1992). Reprocessing data to form QALYs. BMJ, 305(6845), 87-90.
DeLee, J. G., & Charnley, J. (1976). Radiological demarcation of cemented sockets in total hip replacement. Clin Orthop Relat Res(121), 20-32.
Gie, G. A., Linder, L., Ling, R. S., Simon, J. P., Slooff, T. J., & Timperley, A. J. (1993). Impacted cancellous allografts and cement for revision total hip arthroplasty. J Bone Joint Surg Br, 75(1), 14-21.
Gruen, T. A., McNeice, G. M., & Amstutz, H. C. (1979). "Modes of failure" of cemented stem-type femoral components: a radiographic analysis of loosening. Clin Orthop Relat Res(141), 17-27.
Harris, W. H. (1969). Traumatic arthritis of the hip after dislocation and acetabular fractures: treatment by mold arthroplasty. An end-result study using a new method of result evaluation. J Bone Joint Surg Am, 51(4), 737-755.
Kanis, J. A., Johnell, O., Oden, A., Dawson, A., De Laet, C., & Jonsson, B. (2001). Ten year probabilities of osteoporotic fractures according to BMD and diagnostic thresholds. Osteoporos Int, 12(12), 989-995. doi: 10.1007/s001980170006
Rosser, R., & Kind, P. (1978). A scale of valuations of states of illness: is there a social consensus? Int J Epidemiol, 7(4), 347-358.
Shi, H. Y., Mau, L. W., Chang, J. K., Wang, J. W., & Chiu, H. C. (2009). Responsiveness of the Harris Hip Score and the SF-36: five years after total hip arthroplasty. Qual Life Res, 18(8), 1053-1060. doi: 10.1007/s11136-009-9512-0
Zmistowski, B., Hozack, W. J., & Parvizi, J. (2011). Readmission rates after total hip arthroplasty. JAMA, 306(8), 825; author reply 825-826. doi: 10.1001/jama.2011.1182